CLAIMS:

What is claimed is:

1. An optical switch facilitating the verification of optical path integrity, comprising a plurality of optical signal ports and at least one optical switching element for causing an optical signal incident along a first optical signal port to be transmissively coupled to a second optical signal port, the optical switch further comprising:

a supplemental signal detector coupled to the second optical signal port for detecting a supplemental signal associated with the optical signal.

2. The optical switch of claim 1 wherein the optical switch receives information about at least one attribute of the detected supplemental signal from the supplemental signal detector and issues a fault indication if the attribute does not meet an expected criterion.

3. The optical switch of claim 2 wherein the criterion is affected by information from a source outside of the optical switch.

4. The optical switch of claim 2 wherein the criterion is determined based upon at least one previously detected value of the attribute.

5. The optical switch of claim 4 wherein the attribute is an amplitude level related to the supplemental signal.

6. An optical switch facilitating the verification of optical path integrity, comprising a plurality of optical signal ports and at least one optical switching element for causing an optical signal incident along a first optical signal port to be transmissively coupled to a second optical signal port, the optical switch further comprising:

a first supplemental signal detector coupled to the first optical signal port for detecting a supplemental signal associated with the optical signal; and

a second supplemental signal detector coupled to the second signal port for detecting the supplemental signal associated with the optical signal.

7. The optical switch of claim 6 wherein the first supplemental signal detector determines information about at least one attribute of the detected supplemental and the optical switch issues a fault indication if the attribute does not meet an expected criterion.

8. The optical switch of claim 7 wherein the expected criterion is affected by information from a source outside of the optical switch.

9. The optical switch of claim 6 wherein the optical switch receives information about at least one attribute of the detected supplemental signals from both first and second supplemental signal detectors and issues a fault indication based at least upon whether the information about the attribute detected in the first supplemental signal agrees with the information about the attribute detected in the second supplemental signal.

10. The optical switch of claim 6 wherein the optical switch receives information about at least one attribute of the detected supplemental signals from both first and second supplemental signal detectors and issues a fault indication if either the attribute for the first supplemental signal does not meet a first expected criterion or, inclusively, the attribute for the second supplemental signal does not meet a second expected criterion.

11. The optical switch of claim 10 wherein the optical switch obtains information from a remote source affecting at least one of the first and second expected criteria.

12. The optical switch of claim 6 wherein the first supplemental detector determines a first amplitude value of the supplemental signal and the second supplemental detector determines a second amplitude value of the supplemental signal and a loss value is calculated by subtracting the first amplitude value from the second amplitude value.

13. The optical switch of claim 12 wherein the optical switch issues a fault indication when the loss value exceeds a criterion.

14. The optical switch of claim 13 wherein the criterion is based upon previous values of the loss value.

15. The optical switch of claim 13 wherein the criterion is affected by information from a source outside of the optical switch.

16. An optical switch facilitating the verification of optical path integrity, comprising a plurality of optical signal ports and at least one optical switching element for causing an optical signal incident along a first optical signal port to be transmissively coupled to a second optical signal port, the optical switch further comprising:

a supplemental signal injector coupled to the first optical signal port for adding a supplemental signal associated with the optical signal.

17. The optical switch of claim 16 further comprising:

a supplemental signal detector coupled to the second signal port for detecting the supplemental signal associated with the optical signal.

18. The optical switch of claim 17 wherein the supplemental signal detector determines information about at least one attribute of the detected supplemental signal and the optical switch issues a fault indication based upon whether the attribute meets an expected criterion.

19. The optical switch of claim 17 wherein the optical switch determines the value of at least one attribute of the supplemental signal injected by the supplemental signal injector and receives information about the value of the attribute detected in the supplemental signal from the supplemental signal detector and issues a fault indication based upon whether the

value of the attribute detected by the supplemental signal detector agrees with the value of the attribute imparted by the supplemental signal injector.

20. An optical switch facilitating the verification of optical path integrity, comprising a plurality of optical signal ports and at least one optical switching element for causing an optical signal incident along a first optical signal port to be transmissively coupled to a second optical signal port, wherein the optical signal has an associated first supplemental signal originating outside of the optical switch, the optical switch further comprising:

a supplemental signal injector coupled to the first optical signal port for adding a second supplemental signal associated with the optical signal.

21. The optical switch of claim 20 further comprising a supplemental signal detector coupled to the second signal port for detecting at least one of the first and second supplemental signals associated with the optical signal.

22. The optical switch of claim 21 wherein the optical switch determines the value of at least one attribute of the second supplemental signal injected by the supplemental signal injector and receives information from the supplemental signal detector about the value of the attribute detected in the second supplemental signal and issues a fault indication based at least upon whether the detected attribute value agrees with the attribute value imparted by the supplemental signal injector.

23. The optical switch of claim 21 wherein the supplemental signal detector detects the first and second supplemental signals and issues a fault indication if either the first supplemental signal does not meet a first expected criterion or, inclusively, the second supplemental signal does not meet a second expected criterion.

24. The optical switch of claim 21 wherein the second supplemental signal differs from the first supplemental signal such that the supplemental signal detector may distinguish the second supplemental signal from the first supplemental signal.

25. The optical switch of claim 24 wherein the supplemental signal detector selectively detects the first supplemental signal and causes a fault indication to be issued depending on whether the first supplemental signal meets an expected criterion.

26. The optical switch of claim 24 wherein the supplemental signal detector selectively detects the second supplemental signal and causes a fault indication to be issued depending on whether the second supplemental signal meets an expected criterion.

27. An optical switch facilitating the verification of optical path integrity, comprising a plurality of optical signal ports and an optical switching matrix for causing an optical signal incident along a first optical signal port to be transmissively coupled to a second optical signal port, wherein the optical signal has an associated first supplemental signal originating outside of the optical switch, the optical switch further comprising:

a supplemental signal modifier coupled to the first optical signal port which may change the first supplemental signal into a second supplemental signal associated with the optical signal.

28. The optical switch of claim 27 further comprising a supplemental signal detector coupled to the second signal port for detecting at least one supplemental signal associated with the optical signal.

29. The optical switch of claim 28 wherein the supplemental signal detector detects the second supplemental signal and causes a fault indication to issue depending at least upon whether the second supplemental signal meets an expected criterion.

30. The optical switch of claim 28 wherein the optical switch determines the value of at least one attribute of the second supplemental signal imparted by the supplemental signal modifier and receives information from the supplemental signal detector about the value of the attribute detected in the second supplemental signal and issues a matrix fault indication

depending at least upon whether the detected value of the attribute agrees with the value imparted by the supplemental signal modifier.

31. The optical switch of claim 28 wherein the optical switch infers at least one attribute of the first supplemental signal by detection of the second supplemental signal and issues a fault indication depending at least upon whether the attribute meets an expected criterion for the first supplemental signal.

32. The optical switch of claim 31 wherein the criterion is affected by information from a source outside of the optical switch.

33. The optical switch of claim 28 wherein the optical switch infers at least one attribute of the first supplemental signal by detecting the second supplemental signal and issues a fault indication depending at least upon whether the first supplemental signal does not meet a first expected criterion or, inclusively, the second supplemental signal does not meet a second expected criterion.

34. The optical switch of claim 33 wherein at least one of the first and second criteria are affected by information from a source outside of the optical switch.

35. The optical switch of claim 27 wherein at least one attribute of the first supplemental signal is detected by the supplemental signal modifier and the optical switch issues a fault indication depending at least upon whether the attribute meets an expected criterion.

36. The optical switch of claim 35 wherein the criterion is affected by information from a source outside of the optical switch.

37. The optical switch of claim 28 wherein at least one attribute of the first supplemental signal is detected by the supplemental signal modifier and the attribute of the first

supplemental signal is also inferred from the second supplemental signal received by the supplemental signal detector and the optical switch issues a fault indication depending at least upon whether the value of the attribute detected by the supplemental signal modifier differs from the value of the attribute detected by the supplemental signal detector.

38. In an optical network comprising at least one optical switch, a method for verifying optical signal routing comprising the steps of:

providing in the network at least one optical signal having at least one attribute of known value;

directing the network to route the optical signal to a first port of the optical switch;

directing the optical switch to couple the first port to the second port;

at a second port of the optical switch, sensing the attribute of the optical signal and determining a detected value for the attribute;

comparing the detected value of the attribute to the known value of the attribute; and

determining whether the optical signal is being routed correctly based at least upon whether the detected value agrees with the known value.

39. The method of claim 38 wherein the attribute of known value relates to at least one supplemental signal associated with the optical signal and the detector determines the detected value of the attribute by detecting the supplemental signal.

40. In an optical network comprising at least one optical switch, a method for verifying optical signal routing comprising the steps of:

providing at least one optical signal at a first port of the optical switch, the optical signal having at least one attribute of known value;

at a second port of the optical switch, sensing the attribute of the optical signal and determining a detected value for the attribute;

comparing the detected value to the known value; and

determining whether the first port is optically coupled to the second port based upon whether the detected value agrees with the known value.

41. The method of claim 40 wherein the attribute of known value relates to a supplemental signal associated with the optical signal and the detector determines the detected value of the attribute by detecting the supplemental signal.

42. The method of claim 41 wherein the supplemental signal becomes associated with the optical signal substantially near the first port.

43. The method of claim 41 wherein the providing of the at least one optical signal at the first port of the optical switch is accomplished by coupling a supplemental signal injector to an optical line associated with the first port.

44. The method of claim 41 wherein the known value is established by modifying the supplemental signal associated with the optical signal, the modifying occurring substantially near the first port.

45. The method of claim 40 wherein the providing the optical signal is accomplished by providing the optical signal in the network and directing the signal through the network to the first port of the optical switch.

46. The method of claim 45 wherein the attribute of known value relates to a supplemental signal associated with the optical signal and the detector determines the detected value of the attribute by detecting the supplemental signal.

47. In an optical network comprising at least one optical switch, a method for verifying optical signal routing comprising the steps of:

providing to the network at least one optical signal having at least one detectable attribute;

at the first port of the optical switch, detecting the detectable attribute and determining a first detected value for the detectable attribute;

at the second port of the optical switch, detecting the detectable attribute and determining a second detected value for the detectable attribute;

determining whether the first port is optically coupled to the second port based upon whether the first detected value agrees with the second detected value.

48. The method of claim 47 wherein the detectable attribute relates to a supplemental signal associated with the optical signal and the first and second detected values of the detectable attribute are determined by detecting the supplemental signal.

49. In an optical network comprising at least one optical switch, a method for verifying optical path integrity comprising the steps of:

providing within the network at least one optical signal having associated therewith at least one first supplemental signal;

directing the network to route the optical signal to a first port of the optical switch,

at a point before the optical signal enters a first port, adding at least one second supplemental signal associated with the optical signal;

directing the optical switch to couple the first port to a second port of the optical switch;

at the second port, detecting at least one of the first and second supplemental signals; and

responsive to the detection of at least one of the first and second supplemental signals, determining optical path integrity in the optical network.

50. The method of claim 49 wherein the first supplemental signal is distinguishable from the second supplemental signal.

51. The method of claim 50 further comprising the steps of:

establishing a first value of at least one attribute of the first supplemental signal;

at the second port, selectively detecting the first supplemental signal and determining a second value of the attribute; and

determining whether the optical signal is correctly routed based upon whether the first value agrees with the second value.

52. The method of claim 50 further comprising the steps of:

establishing a first value of at least one attribute of the second supplemental signal;

at the second port, selectively detecting the second supplemental signal and determining a second value of the attribute; and

determining whether the optical signal is correctly routed based upon whether the first value agrees with the second value.

53. In an optical network comprising at least one optical switch, a method for verifying optical path integrity comprising the steps of:

providing in the network at least one optical signal having at least one first supplemental signal associated therewith;

directing the network to route the optical signal to a first port of the optical switch;

as the optical signal approaches the first port, associating a second supplemental signal with the optical signal;

directing the optical switch to couple the first port to a second port of the optical switch;

at the second port, detecting the second supplemental signal;

indirectly determining at least one attribute of the first supplemental signal based upon the detected second supplemental signal; and

determining whether the routing of the optical signal is correct based upon the indirectly determined attribute.

54. The method of claim 53 wherein the first supplemental signal does not reach the second port.

55. The method of claim 54 wherein the second supplemental signal replaces the first supplemental signal.

56. The method of claim 53 wherein the second supplemental signal bears a known relationship to the first supplemental signal.

57. The method of claim 56 wherein the second supplemental signal is created from first supplemental signal by a known operation.

58. The method of claim 57 wherein in the second supplemental signal is formed by modifying the first supplemental signal.

59. The method of claim 58 wherein the second supplemental signal is formed by addition to the first supplemental signal and the first supplemental signal is substantially intact within the second supplemental signal.

60. In an optical network comprising at least one optical switch, a method for determining optical path integrity, comprising the steps of :

providing at a first port of the optical switch at least one optical signal having associated therewith at least one supplemental signal;

directing the optical switch to couple the first port to a second port of the optical switch;

at the second port, detecting the supplemental signal and determining a first detected value for at least one attribute of the supplemental signal;

at the second port, detecting the supplemental signal and determining a second detected value for the attribute of the supplemental signal, wherein the second detected value is determined at a different time than the first detected value; and

determining whether the carrying of the optical signal in the network has varied based at least upon comparison of the first detected value to the second detected value.

61. In an optical network comprising at least one optical switch, a method for determining optical path integrity, comprising the steps of :

providing, to a first port of the optical switch, at least one optical signal having associated therewith at least one supplemental signal having at least one attribute;

establishing a first value for the attribute applicable to the optical signal upon entry to the first port,

directing the optical switch to couple the first port to a second port of the optical switch;

at the second port, detecting the supplemental signal and determining a second value for the attribute;

at a first instant in time, computing a first difference value between the first value and second value;

determining optical path integrity based upon the first difference value.

62. The method of claim 61 wherein the attribute is related to amplitude

63. The method of claim 61 wherein the attribute is related to wavelength

64. The method of claim 61 wherein the attribute is related to frequency of the supplemental signal

65. The method of claim 61 wherein the first value is established by detecting the supplemental signal and determining the first value by measurement.

66. The method of claim 61 wherein the first value is established by providing a supplemental signal wherein the first value is accurately set to a specific value.

67. The method of claim 61 further comprising:

at a second instant in time distinct from the first instant in time, determining a second difference value in the same manner as the determining of the first difference value; and

determining optical path integrity based at least upon comparison among the first and second difference values.

68. An optical switch facilitating the verification of optical path integrity, comprising a plurality of optical signal ports and at least one optical switching means for causing an optical signal incident along a first optical signal port to be transmissively coupled to a second optical signal port, the optical switch further comprising:

at least one supplemental signal detecting means coupled to the second optical signal port for detecting at least one supplemental signal associated with the optical signal and determining a value of at least one attribute of the supplemental signal.

69. The optical switch of claim 68 further comprising

attribute evaluating means for determining whether the value of the attribute meets at least one criterion; and

fault indicating means for issuing a fault indication based upon whether the value of the attribute meets the criterion.

70. The optical switch of claim 69 further comprising communicating means for communicating with a source outside the optical switch to affect the criterion.

71. The optical switch of claim 69 wherein the criterion is determined based upon at least one previously detected value of the attribute.

72. The optical switch of claim 71 wherein the attribute is an amplitude level related to the supplemental signal.

73. An optical switch facilitating the verification of optical path integrity, comprising a plurality of optical signal ports and at least one optical switching means for causing an

optical signal incident along a first optical signal port to be transmissively coupled to a second optical signal port, the optical switch further comprising:

a first supplemental signal detecting means coupled to the first optical signal port for detecting a supplemental signal associated with the optical signal; and

a second supplemental signal detecting means coupled to the second signal port for detecting the supplemental signal associated with the optical signal.

74. The optical switch of claim 73 further comprising:

means for determining the value of at least one attribute of the detected supplemental signal from the first supplemental signal detecting means; and

fault indicating means for issuing a fault indication based at least upon whether the value of the attribute does not meet at least one criterion.

75. The optical switch of claim 74 further comprising communicating means for communicating with a source outside the optical switch to affect the criterion.

76. The optical switch of claim 73 further comprising:

comparing means for comparing a first sampling of the supplemental signal as detected by the first supplemental signal detecting means to a second sampling of the supplemental signal as detected by the second supplemental signal detecting means; and

fault indicating means coupled to the comparing means for issuing a fault indication based at least upon whether the first sampling is substantially consistent with the second sampling.

77. The optical switch of claim 73 further comprising:

comparing means for comparing a first value of at least one attribute of the supplemental signal as detected by the first supplemental signal detecting means to a second value of the attribute supplemental signal as detected by the second supplemental signal detecting means; and

fault indicating means coupled to the comparing means for issuing a fault indication based at least upon whether the first value is substantially consistent with the second value.

78. The optical switch of claim 73 wherein the first supplemental detecting means determines a first amplitude value of the supplemental signal and the second supplemental detecting means determines a second amplitude value of the supplemental signal, further comprising:

a loss determining means which determines a loss value by calculating a difference between the first amplitude value and the second amplitude value.

79. The optical switch of claim 78 further comprising:

fault indicating means coupled to the loss determining means for issuing a fault indication based at least upon whether the loss value meets a criterion.

80. The optical switch of claim 79 wherein the criterion is based upon previous values of the loss value.

81. The optical switch of claim 79 further comprising communicating means for communicating with a source outside the optical switch to affect the criterion.

82. An optical switch facilitating the verification of optical path integrity, comprising a plurality of optical signal ports and at least one optical switching means for causing an optical signal incident along a first optical signal port to be transmissively coupled to a second optical signal port, the optical switch further comprising:

a supplemental signal injecting means coupled to an optical line associated with the first optical signal port for adding a supplemental signal associated with the optical signal.

83. The optical switch of claim 82 further comprising:

a supplemental signal detecting means coupled to a second optical line associated with the second signal port for detecting the supplemental signal associated with the optical signal.

84. The optical switch of claim 83 further comprising:

means for determining the value of at least one attribute of the detected supplemental signal from the supplemental signal detecting means; and

fault indicating means for issuing a fault indication based at least upon whether the value of the attribute does not meet at least one criterion.

85. The optical switch of claim 83 further comprising:

comparing means for comparing the supplemental signal as injected by the supplemental signal injecting means to the supplemental signal as detected by the second supplemental signal detecting means; and

fault indicating means coupled to the comparing means for issuing a fault indication based at least upon whether the detected supplemental signal is substantially consistent with the injected supplemental signal.

86. The optical switch of claim 83 further comprising:

comparing means for comparing a first value of at least one attribute of the supplemental signal as injected by the supplemental signal injecting means to a second value of the attribute supplemental signal as detected by the second supplemental signal detecting means; and

fault indicating means coupled to the comparing means for issuing a fault indication based at least upon whether the first value is substantially consistent with the second value.

87. An optical switch facilitating the verification of optical path integrity, comprising a plurality of optical signal ports and at least one optical switching means for causing an optical signal incident along a first optical signal port to be transmissively coupled to a

second optical signal port, wherein the optical signal has an associated first supplemental signal originating outside of the optical switch, the optical switch further comprising:

supplemental signal injecting means coupled to the first optical signal port for adding at least one second supplemental signal associated with the optical signal.

88. The optical switch of claim 87 further comprising a supplemental signal detecting means coupled to the second signal port for detecting at least one of the first and second supplemental signals associated with the optical signal.

89. The optical switch of claim 88 further comprising:

comparing means for comparing the supplemental signal as injected by the supplemental signal injecting means to the supplemental signal as detected by the second supplemental signal detecting means; and

fault indicating means coupled to the comparing means for issuing a fault indication based at least upon whether the detected supplemental signal is substantially consistent with the injected supplemental signal.

90. The optical switch of claim 88 further comprising:

comparing means for comparing a first value of at least one attribute of the supplemental signal as injected by the supplemental signal injecting means to a second value of the attribute supplemental signal as detected by the second supplemental signal detecting means; and

fault indicating means coupled to the comparing means for issuing a fault indication based at least upon whether the first value is substantially consistent with the second value.

91. The optical switch of claim 88 wherein the second supplemental signal differs from the first supplemental signal sufficiently that the supplemental signal detecting means may distinguish the second supplemental signal from the first supplemental signal.

92. The optical switch of claim 91 wherein the supplemental signal detecting means selectively detects the first supplemental signal and further comprises:

fault indicating means coupled to the supplemental signal detecting means for issuing a fault indication if the first supplemental signal does not meet an expected criterion.

93. The optical switch of claim 91 wherein the supplemental signal detecting means selectively detects the second supplemental signal and further comprises:

fault indicating means coupled to the supplemental signal detecting means for issuing a fault indication if the second supplemental signal does not meet an expected criterion.

94. An optical switch facilitating the verification of optical path integrity, comprising a plurality of optical signal ports and at least one optical switching means for causing an optical signal incident along a first optical signal port to be transmissively coupled to a second optical signal port, wherein the optical signal has an associated first supplemental signal originating outside of the optical switch, the optical switch further comprising:

supplemental signal modifying means, coupled to a first optical line associated with the first optical signal port, for changing the first supplemental signal into a second supplemental signal associated with the optical signal.

95. The optical switch of claim 94 further comprising a supplemental signal detecting means coupled to the second signal port for detecting at least one supplemental signal associated with the optical signal.

96. The optical switch of claim 95 wherein the supplemental signal detecting means detects the second supplemental signal and further comprises:

fault indicating means coupled to the supplemental signal detecting means for issuing a fault indication if the second supplemental signal does not meet an expected criterion.

97. The optical switch of claim 95 further comprising:

comparing means for comparing a first value for at least one attribute of the second supplemental signal as determined by the supplemental signal modifying means to a second value of the attribute as detected by the second supplemental signal detecting means; and

fault indicating means coupled to the comparing means for issuing a fault indication based at least upon whether the second value is substantially consistent with the first value.

98. The optical switch of claim 95 wherein the optical switch infers at least one attribute of the first supplemental signal by detection of the second supplemental signal and issues a fault indication if the attribute does not meet an expected criterion for the first supplemental signal.

99. The optical switch of claim 98 further comprising communicating means for communicating with a source outside the optical switch to affect the criterion.

100. The optical switch of claim 95 wherein the optical switch infers at least one attribute of the first supplemental signal by detecting the second supplemental signal and issues a fault indication if either the first supplemental signal does not meet a first expected criterion or, inclusively, the second supplemental signal does not meet a second expected criterion.

101. The optical switch of claim 100 further comprising communicating means for communicating with a source outside the optical switch to affect at least one of the first and second criteria.

102. The optical switch of claim 94 wherein at least one attribute of the first supplemental signal is detected by the supplemental signal modifying means and the optical switch issues a fault indication if the attribute does not meet an expected criterion.

103. The optical switch of claim 102 further comprising communicating means for communicating with a source outside the optical switch to affect the criterion.

104. The optical switch of claim 95 wherein a first value for at least one attribute of the first supplemental signal is detected by the supplemental signal modifying means and a second value for the attribute of the first supplemental signal is also inferred from the second supplemental signal received by the supplemental signal detector and the optical switch issues a fault indication based upon whether the first value agrees with the second value.